

NOTES ON AN OVERLOOKED NUDIBRANCH GENUS, **ROBOASTRA** Bergh 1877, AND TWO ALLIED GENERA (Mollusca: Gastropoda)

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(Text figures 1-6).

SUMMARY

The separation of the species formerly attributed to the nudibranch genus *Nembrotha* Bergh 1877 into three distinct genera (*Nembrotha* s. s., *Tambja* Burn 1962, *Roboastrea* Bergh 1877) is justified by radular and genital differences. Introduced in a footnote 90 years ago and overlooked by later writers, *Roboastrea* is defined for the first time. Two species of *Roboastrea*, *gracilis* (Bergh) and *arika* sp. nov., are recorded from Australian seas; descriptions and figures of each are given.

INTRODUCTION

During a larger investigation of the Australian species of the Doridacean Phanerobranchia Nonsuctoria, it was noticed that several species previously assigned to the genus *Nembrotha* Bergh 1877 show sufficient differences to be reclassified. The discovery of a specimen of *N. gracilis* Bergh 1877 centred attention on this species and its allies, and led, in turn, to the rediscovery of an available generic taxon, *Roboastrea* Bergh 1877, for this species and the recognition of a new species, *R. arika*.

The writer is greatly indebted to the Trustees of the Science and Industry Endowment Fund, C.S.I.R.O., for grants in aid of this and other research, and to Dr. D. F. McMichael, Curator of Molluscs, Australian Museum, for the loan of the material reported upon below. This research is part of a wider study of the Opisthobranchia of Australia.

THE GENUS *NEMBROTHA* BERGH.

The genus *Nembrotha* Bergh (1877: 450) was introduced with six new species, the first of which, *N. nigerrima* Bergh (p. 451) was later designated as type (O'Donoghue, 1924: 567). Since that time 16 nominal species have been added to the genus; some of these are probably synonyms and the actual number is probably considerably less.

Bergh's original six species, though very similar in many ways, are easily divided according to the shape of the radular teeth into three groups. Group I comprising *N. nigerrima* Bergh (p. 451), *N. kubaryana* Bergh (p. 454) and *N. cristata* Bergh (p. 458; 1905: 194) has a rectangular rhachidian with five denticles along the upper margin, a simple cusp on the lateral tooth and 10-11 marginal plates. Group II with species *N. diaphana* Bergh (p. 454) and *N. morosa* Bergh (p. 457; 1905: 195) has a rectangular rhachidian with a smooth upper margin, a bifid cusp on the lateral tooth and three marginal plates. Group III with only *N. gracilis* Bergh (p. 458) has a reduced three-pronged rhachidian, a deeply bifid lateral tooth and two reduced rectangular marginal plates.

The writer's studies of ten Australian species confirm these groups based solely on the differing radulae. Moreover, these studies show that other morphological differences exist by which the three groups can be effectively separated. Thus there is much to justify the proposal that the three groups be raised to full genera. The genera are named as follows (each is defined in detail below):

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Group I: *Nembrotha*. The type species of the original genus, *Nembrotha nigerrima* Bergh, comes within this group and therefore the generic taxon must apply here in the restricted sense (s. s.).

Group II: *Tambja*. The south-eastern Australian *N. (?) verconis* Basedow and Hedley (1905: 158) has the radular characteristics of this group. In a previous paper (Burn, 1962: 98), the genus *Tambja* was introduced with this species as its type. *Tambja* is therefore available for this group.

Group III: *Roboastra*. This rare group (of which only six or so specimens are recorded in the literature) has as its first species *N. gracilis* Bergh. A single-line footnote below the original description of this species (1877: 458) reads "Wahrscheinlich wird diese Art Typ eines neuen Geschlechts (*Roboastra*, Bgh) bilden". Thus, though not qualified by any sort of definition either then or later by Bergh, this name is available for this group. It follows that *N. gracilis* is the type species by original monotypy. Bergh himself appears to have overlooked this taxon as he fails to mention it in any of his later works dealing with *Nembrotha* (1881, 1883, 1890a, 1890b, 1892, 1905, 1907).

CLASSIFICATION

As the writer does not entirely agree with the current classification surrounding the three genera in question, the following arguments for certain alterations are offered.

At present the three genera are included in the family Gymnodorididae (Odhner, 1941: 12; Marcus, 1958: 32, 1965: 277; Marcus and Marcus, 1964: 200; Marcus and Burch, 1965: 236), or the subfamily Gymnodoridinae (Macnae, 1958: 342), the type genus of which is *Gymnodoris* Stimpson (1855: 379). This latter genus and its allies, *Angasiella* Crosse (1864: 50), *Paliolla* Burn (1958: 7), *Lecithophorus* Macnae (1958: 362) and *Analogium* Risbec (1928: 193), are all soft gelatinous bodied species-groups without labial armature, a little differentiated or greatly degenerated radula without rhachidian, and most significantly with a discrete hermaphrodite gland in all instances (except possibly *Lecithophorus*).

Nembrotha, *Tambja* and *Roboastra* have a somewhat stiffer or harder body with or without labial armature, a differentiated radula with a strong rhachidian and the hermaphrodite gland spread over the liver mass. These characteristics among others are also those that unite the subfamilies of the family Polyceridae. It therefore seems logical to separate these three genera from the Gymnodorididae on the basis of these different characters and to create for them a new subfamily, Nembrothinae, of the family Polyceridae. Like Macnae (1958: 342), the writer understands the units of the Polyceridae to be subfamilies not worthy of family status as proposed by Odhner (1941: 11-12).

The new subfamily may be defined as follows: Nembrothinae; Polycerids with strong rhachidian tooth, one large lateral tooth and 1-14 marginal plates each side, with smooth or slightly pustular body (without velum, velar processes and notal or branchial appendages), with weak or no labial armature.

The following key indicates the differences for the separation of the Polycerid subfamilies, and Table 1 lists the genera assigned to each subfamily.

1. Genera possessing ramose or compound processes 2.
Genera with or without simple papillae on the head and notal margins 4.
2. Radula with numerous uniformly tricuspidate teeth KALINGINAE (Pruvot-Fol, 1955: 356).
Radula with differentiated teeth (in some genera with one or more spurious rhachidial plates) TRIOPHINAE. (3).
3. Velum distinct from notal margin TRIOPHINAE s.s.
Processes continuous round entire notal margin, velum not distinct LAILINAE nov.
4. With simple papillae and without rhachidian POLYCERIDAE.
Without papillae and with strong rhachidian NEMBROTHINAE nov.

TABLE 1 — LIST OF GENERA

KALINGINAE	TRIOPHINAE	POLY CERINAE	NEMBROTHINAE
<i>Kalinga</i> Alder and Hancock, 1864.	Triophinae, s.s. <i>Triopha</i> Bergh, 1880. <i>Kaloplocamus</i> Bergh, 1880. <i>Plocamopherus</i> Rüppell and Leuckart, 1828 <i>Joubiniopsis</i> Risbec, 1928. Lallinae, nov. <i>Laila</i> MacFarland, 1905. <i>Limacia</i> Müller, 1778. <i>Holoplocamus</i> Odhner, 1926. <i>Crimora</i> Alder and Hancock, 1864. <i>Issena</i> Iredale and O'Donoghue, 1923.	<i>Polycera</i> Cuvier, 1816. (<i>Palio</i> Gray, 1857). (<i>Greilada</i> Bergh, 1894). <i>Polycerella</i> Verrill, 1881. <i>Thecacera</i> Fleming, 1828. <i>Ohola</i> Bergh, 1883. <i>Galacera</i> Risso-dominguez, 1960.	<i>Nembrotha</i> Bergh, 1877. <i>Tambja</i> Burn, 1962. <i>Roboastra</i> Bergh, 1877.

THE GENERA AND THEIR SPECIES

The writer has examined ten species from the Australian coastlines that are referable to the subfamily Nembrothinae. The generic diagnoses are based upon these examinations while the chronological lists of nominal species are derived from the literature without regard to possible synonymy.

NEMBROTHA Bergh (1887: 450). Rhachidian rectangular with 4-5 denticles along upper margin, lateral tooth with single cusp, marginal plates 6-14. Buccal collar weak; labial armature very weak or absent. Prostate gland large, racemose and spread over spermatheca.

Nominal species: *nigerrima* Bergh, 1877 (type).

kubaryana Bergh, 1877.

cristata Bergh, 1877.

caerula Eliot, 1904.

lineolata Bergh, 1905.

purpureolineata O'Donoghue, 1924.

livingstonei Allan, 1933 (rhachidian denticulate, type examined at Australian Museum, June 1961).

TAMBJA Burn (1962: 98). Rhachidian rectangular with notched or smooth upper margin, lateral tooth with bifid or simple cusp, marginal plates 3-7. Buccal collar strong; labial armature absent. Prostrate gland small, confined to a glandular section of the vas deferens.

Nominal species: *diaphana* (Bergh, 1877).

morosa (Bergh, 1877).

gratiosa (Bergh, 1890).

affinis (Eliot, 1904).

verconis (Basedow and Hedley, 1905) (type).

amitina (Bergh, 1905).

capensis (Bergh, 1907).
limaciformis (Eliot, 1908).
tabescens (Risbec, 1928).
sagamiana (Baba, 1955).
divae (Marcus, 1958).

ROBOASTRA Bergh (1877: 458). Oral tentacles strongly developed as dorso-laterally grooved cylindrical projections equal in length to the rhinophores. Rhachidian reduced with three prongs or well-defined denticles, lateral tooth deeply bifid, marginal plates reduced, linear, 1-3 in number. Buccal collar very weak; labial armature absent. Prostate gland small, confined to a coiled glandular section of the vas deferens.

Nominal species: *gracilis* (Bergh, 1877) (type).
rubropapulosa (Bergh, 1905).
luteolineata (Baba, 1936).
arika Burn, sp. nov.

THE GENUS *ROBOASTRA* IN AUSTRALIAN SEAS

Two specimens, representing two species, have been examined by the writer. Descriptions and figures of their anatomy are presented, together with comments on variation, synonymy and distribution.

ROBOASTRA GRACILIS (Bergh).

(Figs. 1 - 3).

Nembrotha gracilis Bergh, 1877: 458, pl. 56, figs. 11-17.

Nembrotha rubropapulosa Bergh, 1905: 198, pl. 5, fig. 14, pl. 18, figs. 19-22.

Nembrotha gracilis. Baba, 1949: 42, 136, pl. 13, fig. 45, text fig. 39.

Material: Brooms Head, south of Clarence River Heads, northern New South Wales, January 1966, 1 specimen and colour transparency, collected and photographed by Mr. Geoffrey Biddle; Australian Museum reg. no. C.65665.

Description: The single preserved specimen is 13 mm. long, 5.5 mm. high and 3.5 mm. wide; living length was about 25 mm. Alive, the body-colour was dark greenish-black with paler dull greenish foot margins. Along each side lay at least four rows of orange pustules; three or four shorter rows were present on the dorsum in front of and behind the branchiae. The oral tentacles and rhinophores were dull blue-green, the branchiae green. The preserved slug is blue-black with cream lines on the dorsum and sides, blue-black rhinophores and oral tentacles and bluish-green branchiae.

The living slug (Fig. 1) was very slender and highest at the branchial region. Projecting prominently from the head, the pair of cylindrical oral tentacles have a dorso-lateral groove (Baba, 1949: 136, pl. 13, fig. 45a). The four branchiae were simply pinnate. The contractile rhinophores have 15 or more strong lamellae. The whole body surface except the sole was covered with low pustules; the skin in the preserved slug is very thick and tough.

The anterior alimentary tract begins with a long thick-walled muscular oral tube. A very thin blue-green pigmented cuticle lines the oral tube towards the inner end. At the junction of the muscular pharynx and oral tube, a pair of elongate pouches open into the tract. The pouches have purple inner walls. The minute colourless radula (Fig. 2) comprises 26 rows of 2.1.1.1.2 teeth. The rhachidian has three slender denticles, of which the middle one

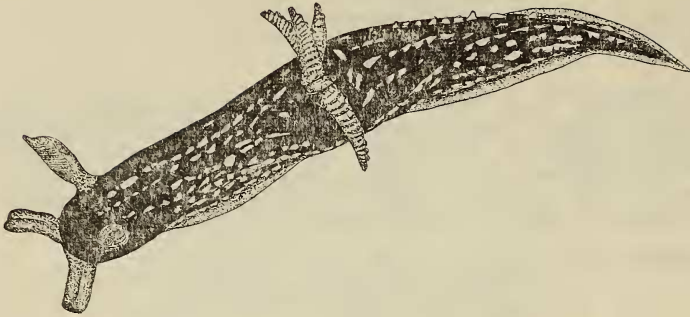


Figure 1.—*Roboastra gracilis*: living slug drawn from a coloured transparency (photo. Geoffrey Biddle).

is a little shorter. The lateral tooth has a strongly curved bifid cusp and a long spur-like denticle near the base. The marginal plates are small and not very distinct; when viewed from some angles, they appear to be a single plate (as in *N. rubropapulosa* Bergh, 1905: 198, pl. 18, fig. 21, b) but when viewed from the side, the two plates are readily visible.

The anterior genital mass (Fig. 3) fills the whole of the second quarter of the body cavity. The ampulla is large, folded thrice upon itself, thin-walled, soft and whitish in colour. The male branch commences with a long horseshoe-shaped soft glandular prostatic dilation that skirts round the spermatocyst. The outer muscular vas deferens is much narrower and a little shorter than the prostatic part. It terminates in a dilated penial section, comprising truncated conical penis armed with numerous hyaline hooks projecting into dark blue pigmented penial sheath. The vagina is long and straight; at its end attaches the large ovoid spermatheca and shortly before this joins the folded slenderer duct of the smaller pyriform spermatocyst. The slender uterine duct was not properly observed; it appears to leave the vagina before the duct of the spermatocyst, thus making the seminal vesicles vaginal in connection. The vagina shares a common aperture within the genital atrium with a rather large pyriform sac (vaginal gland) with narrow lumen and thick spongy vertically plicate walls.



Figure 2.—*Roboastra gracilis*: half row of radula.

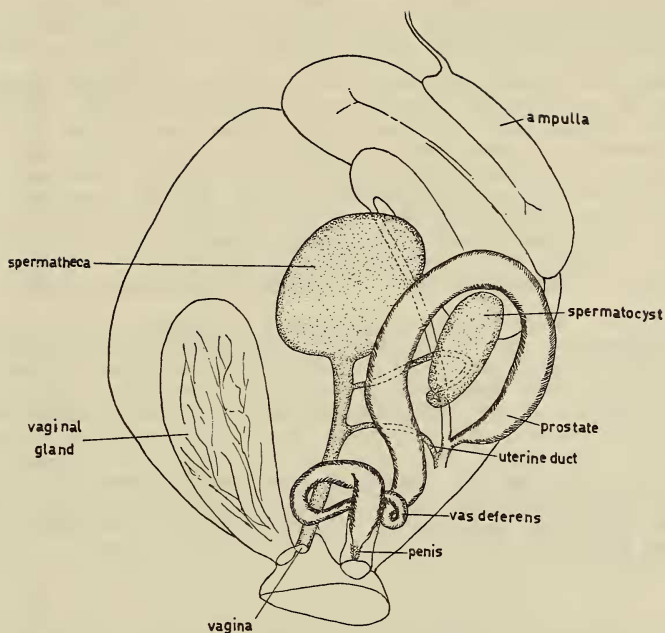


Figure 3.—*Roboastra gracilis*: anterior genital mass.

Discussion: *R. gracilis* is a handsome species at once recognized by its pustulate body and the bands of orange or yellow along the sides and dorsum. Other characteristics are the shorter second cusp of the lateral tooth, the pair of pouches at the anterior of the pharynx, the long prostatic dilation of the male branch, and possibly, the vaginal connection of the seminal vesicles.

Bergh's types were two specimens preserved in alcohol without either notes on or sketches of the living slugs. Subsequently, when the "Siboga" material was reported upon (1905), he described a brightly coloured papillate species as *N. rubropapulosa* (p. 198), which differed only from his *R. gracilis* in that there was one elongate marginal plate on each side of the radular rows. As noted in the above description of the present specimen, the division between the marginal plates can be very difficult to see. Thus *N. rubropapulosa* cannot be effectively separated from *R. gracilis* and must be placed in the synonymy of the latter.

Baba (1949: 136, text fig. 39, c) has shown that this species may have either two or three marginal plates. The number of plates is therefore not a specific characteristic by which the species can be separated from its congeners.

N. rubroocellata Bergh (1905: 201) from which the radula was lost before examination, is very similar to *R. gracilis* in body shape and colour. It may be identical with the latter in which case it will sink into the synonymy.

R. luteolineata (Baba, 1936: 26) and *R. arika* sp. nov. are separated from *R. gracilis* by their smooth skin, different colour patternings and details of the rhachidial and lateral radular teeth.

This is the first record of *R. gracilis* from both New South Wales and Australia. Previous records are from Camiguin Island, Mindanao Sea, Philippines (Bergh, 1877), Saleyer Island, Indonesia (Bergh, 1905), and Japan (Baba, 1949).

While the above description was in proof, a second specimen was received for study. It was collected and photographed by Mr. Geoffrey Biddle, at Minnie Waters, east of Grafton, northern New South Wales during March 1966; Australian Museum reg. no. C.65843. In life it was about 28 mm. long, and as preserved measures 17 mm. long, 6.5 mm. high and 4 mm. wide. Live coloration was almost identical with that of the first specimen with the exception that orange lines are present dorsally and laterally (instead of rows of orange spots, each spot capping a pustule). The specimen is very similar in colour to *N. rubroocellata* Bergh (1905: pl. 4, fig. 14) and strengthens the suggestion that this species is synonymous with *R. gracilis*.

Other data from this second specimen are as follows. Body pustular, skin tough, rhinophores with 20 fine lamellae, and branchiae five in number. Radula small (length about 1 mm.), half as wide as long, colourless, and with formula 28 x 3.1.1.1.3; rhachidian plates present in 28 rows, wider and more curved than in Figure 1; lateral teeth present in 25 rows, rather stronger than in the latter figure but with the same short second cusp; marginals present in 22 rows, each plate distinct, the outermost larger than in the Japanese material (Baba, 1949: text fig. 39). Uterine duct very much shorter than in Figure 3 with its point of insertion with the vagina lying in the crotch of the latter and the duct of the spermatocyst. Thus the vesicles are in vaginal connection as stated above.

ROBOASTRA ARIKA sp. nov.

(Figs. 4 - 6).

Material: On reef near Johnson's Reef, south end of Lord Howe Island, January 1963, 1 specimen (Holotype) collected by Miss Julie Booth, Australian Museum reg. no. C.65666.

Description: The single preserved slug (Fig. 4) is 12 mm. long, 6 mm. high and 3.5 mm. wide. Preserved coloration consists of dark blue-grey lines enclosing paler yellowish areas on the dorsum and sides. The lines run along the head and pallial margins and in addition, there is a median line and three or four lateral lines. The stems of the branchiae are blue-grey and the pinnulae yellowish. The rhinophores are yellowish in front and behind and dark blue at each side. The live slug was probably bright blue and yellow.

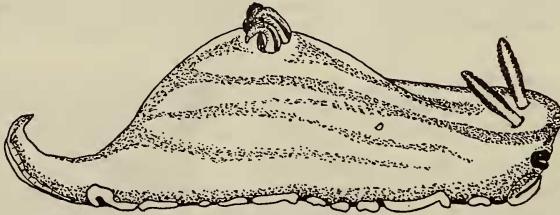


Figure 4.—*Roboastra arika*: preserved Holotype from right side.

The body is shaped like that of *R. gracilis* with a prominent pair of dorsolaterally grooved cylindrical oral tentacles. The skin is entirely smooth and thin. The five branchiae are simply pinnate. The rhinophores have about 18 weak lamellae on each side of the wide anterior and posterior rhachis. The rhinophores are wholly extended.

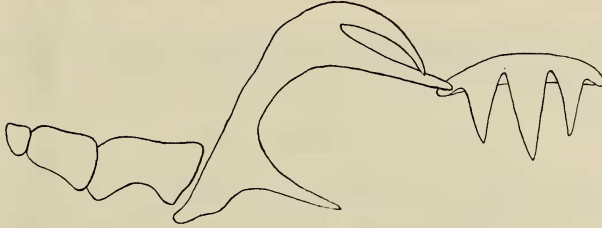


Figure 5.—*Roboastra arika*: half row of radula.

A very thin cuticle lines the oral tube; there is no labial armature. The radula (Fig. 5) has about 31 rows of 3.1.1.1.3 teeth. The rhachidian has three stout tapering denticles. The lateral tooth has a stronger and longer second cusp than in *R. gracilis* and a narrow tapering spur-like denticle near the base. The three marginal plates are more prominent than in *R. gracilis*.

The ampulla (Fig. 6) is small and turban-like. The first part of the male branch is short, twisted, prostatic and soft. The outer part is broader, longer, twisted and muscular. The penial sheath is dilated; the enclosed penis is truncate conical and armed with hyaline hooks. A large vaginal gland opens into the genital atrium. The female gland mass is small and the female ducts not developed.

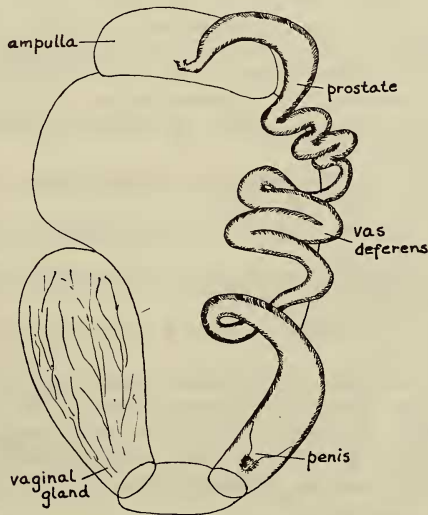


Figure 6.—*Roboastra arika*: anterior genital mass (female ducts not developed).

Discussion: *R. arika* is closely allied to *R. luteolineata* (Baba, 1936: 26) from Okinawa. Both have smooth bodies and overall similar radular shape. The latter species is black or blue-black in colour with narrow orange lines on the dorsum and sides and its radula has shorter denticles on the rhachidian and a more curved lateral tooth with a larger basal denticle. From *R. gracilis* the new species is separated by the smooth body, the detailed shape of the radular teeth, and the shorter, narrower prostatic part of the vas deferens.

This is the first record of *Roboastra* from Lord Howe Island. The specific name *arika* is an Australian aboriginal word meaning "blue water-lily", selected in allusion to the probable live coloration of the species.

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